The Larval and Reproductive Biology of the Giant Crab *Pseudocarcinus gigas*

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Abstract

This thesis documents research on two aspects of the biology of the giant crab *Pseudocarcinus gigas*: the development, behaviour, and rearing of the larvae; and the reproductive biology of both sexes.

Larvae were reared from hatch to juvenile crabs. The larval development of 5 zoeal and one megalopal stages were described which permitted identification of *P. gigas* larvae from plankton samples. Samples from different depths were sorted to obtain information on vertical migration patterns, although few *P. gigas* larvae were collected.

Vertical migration was further investigated in experiments which analysed the swimming response to gravity, light intensity, change in light intensity, light wavelength, change in pressure, current, temperature, and thermoclines. Response to temperature involved a feed-back mechanism that positioned larvae at temperatures optimal for growth, survival, and metamorphosis to megalopa (14-16°C). Light intensity and photoperiod had little effect on survival although larvae reached megalopa most rapidly with long photoperiod and high intensity and were smaller in continuous darkness treatments. Cannibalism of stage 1 and 2 zoeas was highest with long photoperiod and low intensity.

Mycosis and epibiotic fouling of larvae necessitated trials with prophylactic treatments. Survival was highest with a broad spectrum antibiotic (oxytetracyline) while promising results were obtained with carbendazim and copper oxychloride. Suitable concentrations for indefinite baths were established by monitoring toxic effects as increased mortality, deformity, prolonged intermoult, or death during moulting.

The male reproductive tract is typical of brachyurans with ovoid, enveloped, spermatophores stored in the mid vas deferens (MVD). Males pass through three morphological stages (of chela development) and individuals from all three stages had spermatophores in the MVD. Mating pairs were never observed but patterns of limb loss indicate that mating involves female-centred competition. Females appear to mate while soft-shelled with stored sperm remaining viable for at least four years. Broods are produced annually although females occasionally skip a reproductive season, which may be associated with moulting. Several broods may be produced between moults although fecundity declines with successive broods. The hepatopancreas underwent little change in composition during gonadogenesis. Fecundity increased with female size, although not in a simple cubic (volumetric) relationship as larger females produced larger eggs. This increase in egg size was associated with a significant, albeit small, decrease in protein and carotenoid, and an increase in moisture, while lipid appeared unaffected. Protein was used preferentially to lipid during embryogenesis. Techniques for immobilising, humanely killing, and internal imaging of crabs were employed for research on reproduction and are described.

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Contents

Appendices